BELLCOMM, INC.
1100 Seventeenth Street, N.W. Washington, D.C. 20036

SUBJECT: Performance of Operational Intercommunication System-Audio (OIS-A) During Apollo 5 Case 900

DATE: January 29, 1968

FROM: J. E. Johnson
H. Kraus
J. P. Maloy
B. F. O'Brien

ABSTRACT

The Operational Intercommunication System - Audio was monitored at KSC and at MCC-H during the Apollo 5 CDDT and final countdown. This memorandum presents comments on the performance of the system as observed by the monitors. The system performed very well; there were very few service interruptions and very few user complaints. Many instances of crosstalk, clicking sounds, and steady humming noises were observed, but they did not cause any interference with communications. Some user errors such as open microphones and improper voice procedures were noted.

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MEMORANDUM FOR FILE

1.0 Introduction

This memorandum presents the results of observations of the performance of the Operational Intercommuication System Audio (OIS-A) during the Apollo 5 Countdown Demonstration Test (CDDT) and the final countdown. The OIS-A was monitored by MOS (Bellcomm) and MOG personnel at KSC (Launch Complex 37 and CIF) and at the Mission Control Center - Houston (MCC-H). Appendix 1 gives specific details at the monitoring schedule and manning.

The monitoring was performed at a standard OIS terminal equipment at KSC and at a Console Communication Subsystem (CCS) at MCC-H. The basic procedure for monitoring was to check periodically each available channel at half-hour intervals and to note their general condition. At other times, busy channels were observed in order to detect any communication problems.

2.0 Observations at KSC

2.1 General

At KSC, the system was monitored at a standard rack-mounted OIS-A station in Room 101 of the blockhouse on Launch Complex 37 and in the Central Instrumentation Facility (CIF). These stations have a capacity of 21 channels, and any two channels could be monitored simultaneously. The channels available at the Blockhouse station were as follows.

Black 1, 2, 3, 4, 5*, 6*, 7	*added at 1700, 1/19/68
Red 3, 4, 5, 6	
Blue 1, 2, 3*, 4, 5	*added at 1700, 1/19/68
Yellow 1, 2, 3, 4	
Green 3, 5*	*disconnected at 1700, 1/19/68
Brown 1*, 2*	*disconnected at 1700, 1/19/68

Figure 1 shows the assignment of channels for this mission. The channels monitored at the CIF are discussed in Paragraph 2.4.

2.2 Observations During CDDT - Blockhouse (LC 37)

For several hours at the beginning of the CDDT, frequent clicking noises were heard on most channels. The source of the clicks could not be determined. The following is a list of the channels monitored, with general comments on their performance. Detailed comments on their performance are contained in Appendix II.

Black 1

This channel was in general very good, and the users were heard loud and clear. A low hum and crosstalk were heard several times throughout the CDDT. Crosstalk which sounded like a "busy" signal was heard on this channel. This was attributed to the ringing signal received on a point-to-point phone at a console in the firing room.

Black 2

This channel had very little noise, and the users were generally heard loud and clear. There were a few observations and user-complaints of low volume, but it is believed that some of these could be attributed to headset difficulties, rather than channel problems. There were several cases of open microphones and crosstalk, and it was possible at times to determine which channels were creating the crosstalk. The ringing signal crosstalk described above was also present on this channel.

Black 3

This channel had little noise, but crosstalk was heard on several occasions. The channel was bussed with Black 2 on two occasions.

Black 4

This channel had a low hum, almost continuously. There were a few instances of crosstalk, breaking up and open microphones.

Black 5

This channel was generally quiet, and the users were heard loud and clear.

Black 6

There were several instances of crosstalk and a low hum. At one time, the channel reportedly had intermittent communications with the fall-back area.

Black 7

The users were heard loud and clear. A low hum was noted on several occasions. On two occasions, "LIEF" was heard breaking-up.

Red 3

This channel had a hum on it throughout the CDDT, and at times it was loud enough to become annoying. It was noted that Red 3 caused crosstalk on several other channels. At various times, Red 3 was bussed with Red 4 and Blue 4. Users were heard loud and clear.

Red 4 and Red 6

Thses channels had little noise and the users were heard loud and clear. A few instances of open microphones and crosstalk were noted on each.

Red 5

This channel had little noise, and the users were heard loud and clear. A few instances of open microphones were noted. At various times it was bussed with Red 3 and Blue 4.

Blue 1

Quiet. No activity noted.

Blue 2

A low noise was heard most of the time, but users were heard loud and clear. Very little activity was noted

Blue 3

Users heard loud and clear. Several instance of crosstalk noted.

Blue 4

A low hum was heard most of the time, but users were heard loud and clear. It was bussed with Red 3 and Red 5, as noted above.

Blue 5

Quiet. Very little activity noted. Crosstalk was heard several times.

Yellow 1

A low hum was heard most of the time. Very little activity noted. Crosstalk was heard several times.

Yellow 2

A low buzzing sound was heard most of the time. Very little activity noted. Crosstalk from Yellow 1 was heard.

Yellow 3

A low hum was heard during the last several hours of monitoring. A few instances of open microphones were noted. Very little activity was noted.

Yellow 4

A low buzzing sound was heard for several hours. Several instances of crosstalk were noted - once from Red 3. Very little activity was noted.

Green 3, Green 5, Brown 1, Brown 2

Quiet. Very little activity noted.

2.3 Observations During the Launch Countdown - Blockhouse (LC 37)

The crosstalk from the ringing signal to point-to-point telephone was heard primarily on Black 1 and Black 2 throughout the final countdown. The following is a listing of the channels monitored, with general comments on their perform ance. Detailed comments of channel performance are contained in Appendix II.

Black 1

Users were heard loud and clear. Several instance of crosstalk were noted, including crosstalk from Red 3 and Blue 3. A cross of Black 1 and Black 2 was reported by CVTS, and personnel were requested to check their channel switches.

Black 2

Users were heard loud and clear. Several instances of crosstalk were noted. In particular, crosstalk was detected from Red 3 and Black 1. At one time, communication problems between the Blockhouse and the CIF were reported.

Black 3

Few problems were noted, and the users were heard loud and clear. Crosstalk with a "Donald Duck"-like quality was heard on one occasion. It was observed that users on Black 3 from Houston were not as clear as on Black 2, and there appeared to be more word clipping.

Black 4

A low buzzing sound was heard for several hours. The users were normally heard loud and clear. A "Donald Duck"-like crosstalk was heard on one occasion. Word clipping of the word "go" causing it to sould like "O" was heard several times.

Black 5

Users were heard loud and clear. Several instances of crosstalk and open microphones were noted.

Black 6

Users were heard loud and clear. Several instances of crosstalk were noted.

Black 7

A low buzzing sound was heard several times on this channel. The users were heard loud and clear. Crosstalk was heard twice; once from Red 3. On one occasion, JROL had a rain barrel effect.

Red 3

This channel had a steady hum on it most of the time and it was loud enough at times to be annoying. Crosstalk, breaking-up, and open microphones were heard several times. Weak conversations were heard a few times. Communication problems were reported between the blockhouse and the CIF on this channel.

Red 4 - Red 5

These channels were generally quiet, and the users were heard loud and clear.

Red 6

The users were heard loud and clear. A very low buzzing sound was heard several times. A high background noise appeared, but its cause was quickly traced to a loose patch.

Blue 1, Blue 2, Yellow 3, Green 3

Generally quiet with little activity.

Blue 3, Blue 4

A hum was heard most of the time. Crosstalk from Black 2 was heard on two occasions.

Blue 5, Yellow 2, Yellow 4

Low buzzing sound heard most of the time.

Yellow 1

A hum was heard several times, and it was bussed with Red 3 at one time.

2.4 Observations at KSC - CIF

2.4.1 General

At KSC, the system was also monitored at the Central Instrumentation Facility (CIF) for the final portion of the count during the CDDT and the actual countdown.

The circuits available for monitoring were:

Black 1, 2, 5, 6

Red 1, 2, 3, 5, 6

Blue 1, 2, 4, 5

Yellow 3, 4

Brown 2

Grey 1, 2, 3

2.4.2 CDDT Observations

The station was monitored from 0930z on 1/19/68 to 0200z on 1/20/68. General performance comments are noted here, and more detailed comments are given in Appendix IV.

Black 1 - The users levels were lower than on other channels.

Black 5 - Crosstalk and breaking up were observed.

Black 6 - Crosstalk and noise were observed.

Red 5 - A loud background noise was heard on one occasion. Breaking-up was noted.

2.4.3 Countdown Observations

The station was monitored from 1500z to 2200z on 1/22/68. General performance comments are given here, and more detailed comments are given in Appendix IV

Black 1 Levels were better than during the CDDT, and rose to normal level.

Black 5 Users voices sounded choppy at times.

Black 6 Crosstalk and noise were noted once

Red 1, Red 3, and Red 6 - Chopping in the middle of words was noted once.

3.0 Observations at MCC-H

3.1 General

The KSC OIS-A system was monitored using the MCC-H Console Communications Subsystem (CCS) equipment located in the second floor Simulation, Confidence, and Training System (SCATS) control area. The following OIS-A circuits were available to the monitors:

Black 1, 2, 3, and 4

Brown 1

Yellow 3

Green 3, 4, 10, and 5

No single CCS unit contained more than three of the OIS-A circuits thereby precluding simultaneous or rapid access to available circuits. Monitoring was therefore concentrated upon the three most active OIS-A circuits Black 1,2, and 3 with periodic sampling of the remaining circuits whenever possible on a non-interference basis.

Monitoring at MCC-H was performed as follows:

During CDDT:

18/1300Z to 19/0512Z

19/1130Z to 20/0151Z

During Launch Countdown:

21/1730Z to 22/2248Z (T-0)

3.2 Observations During CDDT

This section lists by circuit a general impression of circuit performance. A chronological listing by circuit of non-normal performance is contained in Appendix III.

Overall OIS-A performance was good. Voice levels and fidelity were generally very good with but a few exceptions as noted. The principal contribution to circuit performance degradation during the CDDT was the presence of sporadic clicking or popping noises at a low to medium volume level. These noises were quite prominent during the early part of the CDDT and decreased somewhat towards the end.

Black 1

Voice levels and quality were generally good. Background noise levels were low to medium high. Noises consisted of sporadic clicks or pops on many occasions. Intelligible crosstalk from other channels was heard during most of the latter part of the CDDT. There were intermittent periods during which a low buzzing was observed. Continuous open-microphone conditions were noted for a number of intervals of varying duration. There was one occasion when voice quality of the CLTC was distorted. A complaint of low volume between users at KSC was made on one occasion; however, the volume as monitored at MCC-H was good. One claim of a user breaking up was heard but the monitor noted no evidence of this condition. There was one trouble report of an MCC-H Flight Controller (EECOM) being unable to establish contact with KSC using Black 1 so that he was forced to use Yellow 3. There were two other instances of KSC users having low volume as heard at MCC-H.

Black 2

Voice levels and quality were generally good. Background noise levels ranged from low to medium level. During the early part of the CDDT there was a continuous presence at a low level of dialing clicks and 20-Hz ringing signals. Sporadic clicking at a low to medium level was present during most of the CDDT and increased to a high level for a short interval. The circuit appeared to be particularly susceptible to low-level crosstalk from other circuits. A pulsed buzzing signal (believed to be a KSC loop-ring signal) at medium to high levels was noted occasionally throughout the CDDT. Open microphone conditions were noted quite frequently. There were at least four occasions where KSC voice volume was low, and one occasion where it was claimed to be low but was monitored as good. There were at least three occasions where voice quality was distorted but intelligible, and one occasion where there was an appearance of breaking up. The latter condition was apparently caused by inadvertent releasing of the microphone key by the operator.

Black 3

Voice levels and quality were generally good. Background noise levels were normally very low but increased slightly towards the end of the CDDT. Low level sporadic clicks were noted frequently. Low level crosstalk from other channels (particularly Black 2) was noted frequently. Open microphone conditions were noted at least three times. There was one occasion when the circuit had a hollow sound.

Brown 1

Background noise was noted as low to medium in level. A low to medium level continuous tone was present during the latter portion of the CDDT. Faint crosstalk from other circuits was noted on at least four occasions. One incident of low voice level was noted.

Green 3,4,5, and 10

There was very little traffic on these channels during the CDDT. Background noise normally ranged from very low to low levels. During the last portion of the CDDT the noise level increased to a medium level and a faint tone was heard at times.

Unidentified

There were several instances where the non-normal conditions existed for too short an interval to permit isolation and identification of the circuit. The conditions noted were buzzings, open microphones, and low voice levels.

On one occasion it was reported (on Black 1) that there was intermittent voice communication to the fallback area and it was thought to be caused by a cable. However, the intermittent circuit(s) was not identified and no further discussion of the problem was heard.

At MCC-H a noise tone was heard on all circuits (both OIS-A and non-OIS) being monitored. It is believed that this was an internal MCC-H condition. The condition existed for approximately one minute.

Black 4, Yellow 3

These circuits were not operational in the SCATS control area during the CDDT.

3.0 Launch Countdown Observations

Overall OIS-A performance was approximately identical to that observed during the CDDT. The principal factor contributing to performance degradation was the presence of crosstalk between circuits. The crosstalk levels ranged from low to high, the latter being caused by bussing circuits together.

Since monitoring was performed on a non-interference basis, access was available to only Black 1,2, and 4 during the latter portion of the countdown. This was due to the manning of SCATS control area positions by ARIA operations and simulation personnel.

Black 1

Voice levels and quality were generally good. Background noise ranged from low to medium high levels throughout the monitoring interval. Open microphone conditions were noted at approximately the same rate as during the CDDT. A continuous buzz was present for approximately five hours with the intensity increasing from a low to a medium level during this interval. During a three minute interval a warbling tone of medium level was heard. This changed to a multitone signal and then became a howling noise (high volume) before ending abruptly. (A general announcement was heard on Black 2 to check for open microphones on Black 1. However, this announcement was made after the howling had ceased.) A pulsed buzzing (loop-ring) signal at medium high levels was heard sporadically throughout the monitoring interval. There were at least two instances where KSC personnel voice quality was heard to be "mushy", and one instance where the MCC-H voice signal had an echo. There was one instance where the voice level at KSC was low.

Black 2

Voice levels and quality were generally good. Background noise levels ranged from low to medium. Pulsed buzzing (loop-ring) signals occurred frequently and reached high levels at times. A complaint was voiced by KSC personnel during the latter part of the countdown and the frequency of occurrence of these signals decreased; however, they continued to occur up through the time of launch. As during the CDDT, this circuit appeared to be particularly susceptible to cross-talk from other circuits. During the last three hours of the countdown crosstalk from Black 1 was of a medium to high level and caused the comment that the two circuits were bussed together. There was also high level crosstalk from Red 3 during the latter part of the countdown.

There was one instance where personnel at KSC were unable to contact each other on this circuit but the Houston Flight Director was able to converse with both.

During the late portion of the countdown up to lift-off the Flight Director voice signal had a distinct hollow sound on this circuit only.

There was several instances where breaking-up was reported that was not evident to the monitor. Conversely, there was at least one instance where the monitor detected a party breaking up but heard no comment.

Black 3

Voice levels and quality was generally good. Background noise level ranged from low to medium. The incidence of crosstalk was less than that noted during the CDDT. Sporadic low level clicks, low level buzz, and line ring signals (commercial telephone) at a low level were noted two or three times.

There was one incident when the Flight Director was unable to contact KSC personnel. A communications check was made five minutes later with negative results. No further attempts were monitored until approximately ten hours later at which time contact was established. It could not be determined if this problem had been corrected before the last check.

Black 4

Background noise was noted as medium to medium high in level. A tone ranging in volume from low to medium level was present at almost every sampling of circuit performance. Dialing clicks at a low level were frequently noted. There was no voice traffic monitored.

Brown 1

Background noise level was medium low during most of the sampling times. No extraneous signals were detected. No circuit problems were noted.

Yellow 3

Background noise ranged from medium to high levels. This circuit had the highest noise levels of any of the OIS-A circuits available. Low to medium crosstalk was noted at times. An open microphone condition was noted at least once. No traffic was monitored on this circuit.

Green 3,4,5, and 10

Background noise on these circuits was normally at a low to medium level. A low tone was heard on two occasions, and low crosstalk once. No traffic was monitored on these circuits.

4.0 Summary

The overall performance of the OIS during Apollo 5 was very good. The few instances when satisfactory communications could not be established between users were almost entirely due to improper operating procedures or unavailability of the called party.

Observations at KSC and MCC-H were in general agreement. A somewhat higher noise level was often reported at MCC-H.

The two most prevalent problems were excessive "clicking" during the early part of the CDDT, and a relatively high incidence of crosstalking throughout the entire monitoring period. These problems appeared on most OIS circuits. They were quite noticeable on the two circuits - Black 1 and 2 - that were monitored essentially continuously at both locations. Although the crosstalk was prevalent, it was not at a level that interferred with good communications when that circuit was active. A few circuits exhibited moderate to high noise and all circuits were subjected to occasional buzzes, clicks, and ringing signals. These effects were occasionally annoying or distracting, but rarely were observed to prevent a satisfactory conversation.

Additional items of note were the occurrence of open mike conditions and other incidents involving circuit discipline. The number of occurrences of open microphones should be reduced when non-locking microphone keys are installed in the future. The breaches of circuit discipline included occasions where proper identification of called and calling parties were not used and several times when an active conversation on a loop was interrupted by someone who did not monitor the circuit for availability before talking.

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H. Kraus

J. P. Maloy

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JEJ
HK db
2034-JPM ew
BFO

Attachments
Figure 1
Appendices 1-4

KSC FORM 23-81C (6/64)

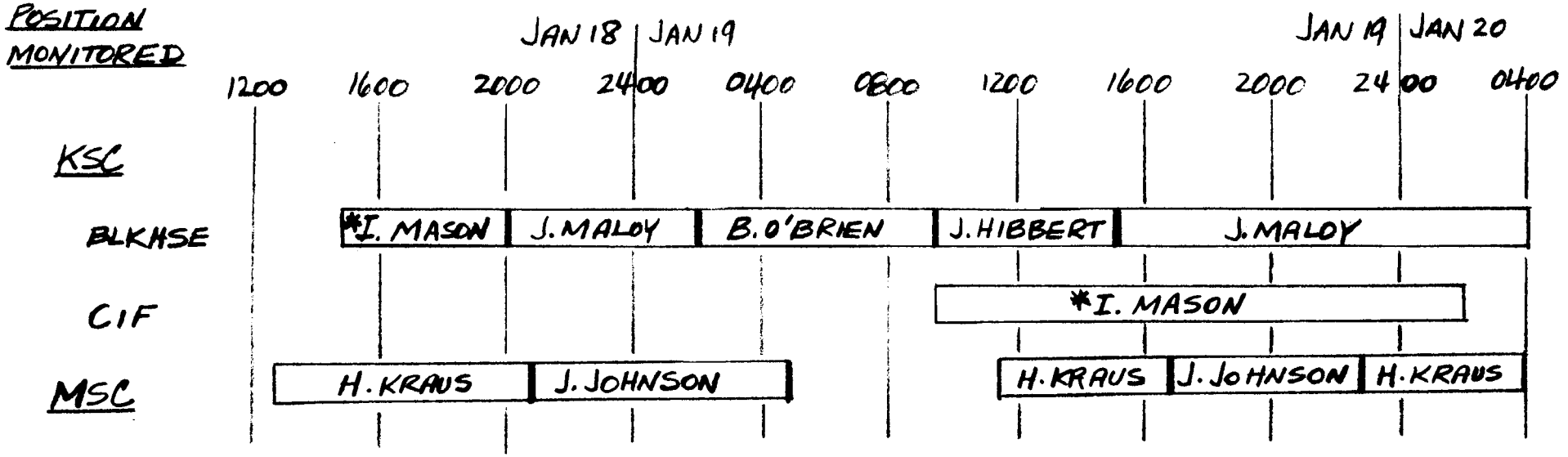
SA-204 LM-1 COMPLEX 37 CHANNEL ASSIGNMENTS OIS

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
SUPERVISION	BLACK	BK-1 LV TEST CONDUCTOR	BK-2 TEST SUPERVISOR (168)	BK-3 SPACECRAFT TEST CONDUCTOR (166)	BK-4 SPACECRAFT TEST ENGINEER (167)	BK-5 S-IB TEST CONDUCTOR	BK-6 S-IVB TEST CONDUCTOR	BK-7 TEST SUPPORT CONTROLLER OTV & OIS (263)							
MECHANICAL	RED	RD-1 S-IB VEH MECH.	RD-2 S-IVB PROP.	RD-3 IU TEST CONDUCTOR	RD-4 S-IB & SUPPORT MECH GSE	RD-5 ENVIRON-MENTAL CONTROL SYSTEM	RD-6 LV PROP								
ELECTRICAL	BLUE	BL-1 S-IB VEH ELECTRICAL	BL-2 S-IVB ELEC. MECH.	BL-3 COMPLEX MANAGER	BL-4 IU VEH ELECTRICAL	BL-5 LV GROUND ELECTRICAL & TROUBLE SHOOTING									
DATA & CONTROL	YELLOW	YW-1 LV STABL & ALIGN	YW-2 LV FLIGHT CONTROL	YW-3 LV GUIDANCE FLIGHT COMPUTER	YW-4 RCA 110A COMPUTER										
MEASURING	BROWN	BR-1 S-IB MEASURING	BR-2 S-IVB MEASURING	BR-3 IU MEASURING	BR-4 GROUND MEASURING										
RF & TM	GREY	GY-1 LV TM	GY-2 LV RF	GY-3 LV DDAS						NOTE: NUMBERS IN PARENTHESIS REFER TO MSO OIS DESIGNATIONS.					
LUNAR MODULE	GREEN	GN-1 LM PAD LEADER (151)	GN-2 LM ELECTRICAL POWER & SEQUENCE (152)	GN-3 LM GUIDANCE & NAVIGATION (153)	GN-4 LM STABILI-ZATION & CONTROL (154)	GN-5 LM COMMUNI-CATIONS (155)	GN-6 LM INSTRUMEN-TATION & TM (156)	GN-7 LM REACTION CONTROL SYSTEM (157)	GN-8 SIA NAA TEST PROJECT ENGINEER (158)	GN-9 LM ECS (161)	GN-10 LM PROPULSION (162)	GN-11 LM ACCEPTANCE CHECKOUT EQUIPMENT (163)	GN-12 LM GSE QUALITY CONTROL (164)	GN-13 LM RADAR (165)	

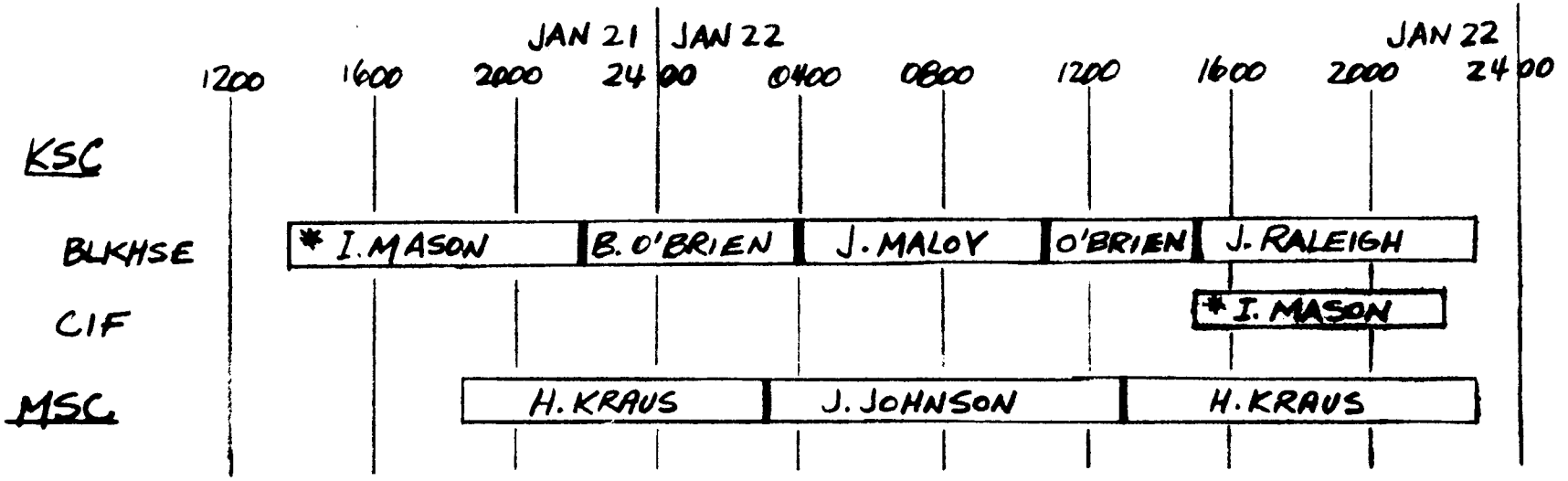
FIGURE 1

APPENDIX I

CDDT TIME (GMT)



LAUNCH CD TIME (GMT)



* MOG REPRESENTATIVE ; ALL OTHERS ARE MOS

APOLLO 5 MONITOR PERSONNEL ASSIGNMENTS

APPENDIX II

Detailed Observations at KSC

This appendix contains a chronological listing by circuit of OIS-A performance comments.

1.0 Observations During CDDT

1.1 BLACK 1

Date/Time(z)	Comments
18/2047	A user complained of low volume
2345	CLTC could not contact CGIF. EECOM could not contact CLTC.
1035	A call to CIF was not answered
19/0356	CLIS/CVTC - low volume
1555	Channel appears to be bussed with Black 2.
1848	An announcement was made to check talk keys.
2019	Only one side of conversation was heard.
20/0112	"Singing" or howling was heard.

1.2 BLACK 2

18/1530	Black 2 and Black 3 bussed - found to be caused by improper setting of channel-selector switch.
2100	"Flight" was heard breaking up.
2130	Crosstalk from Black 1.
2250	A user stated CSDC was breaking up.
19/0230	Crosstalk from Red 3
0244	Crosstalk from Red 3
0413	CVTS sounded weak.
0425	CVTS sounded weak.

0430	Open microphone
0630	CTSC sounded weak, CVTS sounded OK, Safety sounded loud
0648	CTSC sounded very weak
0752	CTSC sounded weak
0900	Open microphone
1555	A user stated that Black 1 and 2 appear to be bussed.
1615	User commented on low level of CTSC.
2106	User commented on low level of another user (George).
0843	CTSC sounded weak
1023	Crosstalk from Black 1
1430	Open microphone
1453	Open microphone
2106	A user's level was low. He stated that he did nothing to cause it.

1.3 BLACK 3

18/1530	Bussed with Black 1
2130	Crosstalk
19/0030	Crosstalk
0500	Crosstalk
1900	Crosstalk

1.4 BLACK 4

18/1630	Static-like background noise heard from one user.
2030	Open microphone.
2130	User heard breaking-up.
2300	Crosstalk
19/1400	User heard breaking-up.

1630	User heard breaking up.

1.5 BLACK 6

19/1225	It was reported that there were intermittent communications with the fallback area.
1800	Crosstalk
2300	Crosstalk
2400	Crosstalk

1.6 BLACK 7

19/0018	"LIEF" was heard breaking-up.
1700	"LIEF" was heard breaking-up.

1.7 RED 3

18/2230	Bussed with Red 5.
2400	Bussed with Red 4.
19/0400	Bussed with Red 5 and Blue 4.

1.8 RED 4

18/2300	Bussed with Red 3.
19/0230	Crosstalk
0700	Open microphone.
0730	Open microphone.

1.9 RED 5

18/2230	Bussed with Red 3.
19/0312	Bussed with Blue 4.
0400	Bussed with Blue 4 and Red 3.
1453	Open microphone.
1556	Open microphone

1.10 RED 6

19/1330	Open microphone.
1900	Open microphone.
2000	Noise sounding like a rush of air was heard.

1.11 BLUE 4

19/0312	Bussed with Red 5.
0400	Bussed with Red 5 and Red 3.
1900	Open microphone.

1.12 YELLOW 1

18/2330	Crosstalk
19/0300	Crosstalk
0530	Crosstalk
0630	Crosstalk

1.13 YELLOW 2

19/0030	Crosstalk

1.14 YELLOW 3

19/0230	Open microphone
0300	Open microphone

1.15 YELLOW 4

0230	Crosstalk heard.
0330	Crosstalk from Red 3 heard.

1.16 BROWN 1

18/2100	Crosstalk
2400	Crosstalk

2.0 Observations During The Launch Countdown

2.1 BLACK 1

Date/Time(z)	Comments
21/1710	User complained of background noise. Located in the support building
22/0245	Crosstalk From Red 3
0425	User breaking-up
0528	Burst of static-like noise
0737	Crosstalk
0800	Crosstalk
1530	Open microphone
1830	Loud crosstalk or bussing between Black 1 and Black 2.
2015	Crosstalk from Blue 3.
2115	Open microphone.
2130	CVTS reported major cross between Black 1 and Black 2. Requested users to check channel switch.

2.2 BLACK 2

22/0107	SRO stated he was having trouble reaching Houston Flight.
0127	Crosstalk from Red 3.
0220	KSTC stated that he heard only one side of a conversation between Launch Complex 37 and MSO.
0331	User said he heard a burst of noise.
1252	A momentary rushing noise was heard
1333	CVTS commented on the good quality of communications. The level between the blockhouse and CIF was said to be low.

1408	BCPA sounded weak. BCPA was told by CVTS to identify himself.
1438	CTSC sounded weak.
1510	An annoying buzzing sound was heard.
1542	A user complained of a roaring sound. Not heard by monitor.
1550	CVTS complained about noise on the channel.
1830	Crosstalk or bussing between Black 1 and Black 2.
2123	Noise on channel.
2130	CVTS reported major cross between Black 1 and Black 2. Request for users to check channel switch.

2.3 BLACK 3

22/1550	Short burst of noise.
1740	Crosstalk with "Donald Duck" like quality was heard.
2220	User sounded weak and was breaking-up.
2224	Black 3 from MCC-H not as clear as Black 2. There appeared to be more clipping of words

2.4 BLACK 4

0904	Crosstalk with a "Donald Duck" like quality was heard.
1550	The words "Go" or "No" sounded like "OO" to observers in blockhouse.
1755	Crosstalk
1915	Tone

2.5 BLACK 5

22/0400	Crosstalk
0500	Crosstalk

0700	Crosstalk
0900	Open microphone
1500	Open microphone
1730	Open microphone

2.6 BLACK 6

22/0400	Crosstalk
0500	Crosstalk
2030	Crosstalk

2.7 BLACK 7

22/0117	Crosstalk from Red 3
0430	Open microphone
0600	User breaking up
0618	Two users calling at the same time.
0638	Two users calling at the same time.
0930	Crosstalk
1500	User breaking up

2.8 RED 3

21/2353	AEBR sounds weak
22/0148	User reported communication problems to CIF
0425	Loud Hum
0615	Crosstalk
0800	Crosstalk
0805	User sounded weak
0825	Loud hum momentarily. Someone blowing in microphone.
0930	Crosstalk or bussing with Red 4.
1230	Crosstalk

1300	Crosstalk
1400	Bussed with Yellow 1
1523	CUDK heard breaking up
1812	Open microphone
1916	Open microphone

2.9 RED 6

21/1845	High background noise heard on the "monitor" position, not on the "active" position. Trouble traced to a loose patch.

2.10 BLUE 3

21/2248	Crosstalk from Black 2.
2313	Open microphone
2357	Crosstalk from Black 2.
0129	Users sounded low.
22/0530	Crosstalk
0700	Crosstalk

2.11 YELLOW 1

22/1400	Bussed with Red 3
1851	Loud hum
1916	Hum
2045	Loud hum

2.12 YELLOW 2

22/2045	Loud hum

2.13 YELLOW 3

21/1830	Noisy. Open patch found.

APPENDIX III

Observations at MCC-H

This appendix contains a chronological listing by circuit of OIS-A performance comments by MCC-H monitors.

1.0 Observations During CDDT

1.1 Black 1

Date/Time(Z)	Comments
18/1330	Open mike.
1359	Open mike (re 1330Z) located.
1705	"Pinging" sounds as if circuit was about to break. into oscillation.
1739	CLTC distorted - peak clipping.
1742	CVTC voice volume somewhat lower than normal.
2016	Open mike.
2045	CLIF/CLES. Headphone check. CLIF claimed CLES volume a little low (sounded OK to monitor.)
2218	Buzzing.
2220	CLTC/ETMS. CLTC position could hear but was unable to answer original call.
2231	CVTC/CLTC. Unable to raise CVTC on first try.
2236	Same as 2218.
2237	Buzz. Off at 2238.
2239	(See Black 2 entry for 18/2239.)
2240	CIF reported as first broken-up, then coming in low. Monitored OK at MCC-H). Someone gave test count. Test count accompanied by background rushing noise.
2345	EECOM reported on FD loop that he was unable to get through on Black 1.
19/0451	Unintelligible Xtalk (sounds like adjacent channel.)
1219	CVTC though he was calling on Red 1. Corrected by CLTC.
1607	Xtalk from Black 2.
1718	Xtalk (unidentified source.)
2213	Xtalk from Black 2.
2226	Xtalk from Black 2 (Very pronounced).
2335	Buzz, increasing in intensity.
20/0004	CLTC/CITC. CITC voice level low, CLTC OK.
0058	CVTS came up on Black 1 and Black 2 simultaneously.

1.2 Black 2

Date/Time(Z)	Comments
18/1540	Crosstalk from Black 3.
1735	CVTS/CTSC. CTSC slightly distorted - peak clipping.
1830	Open mike. Cleared at approximately 2016Z.
1844	CVTS/KSTC. Required 3-minutes to obtain response from CVTS.
2239	(Monitored: " ..... hear your Black 1 is back in. OK, will check.")
2314	Noisy buzzes. Clicking.
0230	Low-level Xtalk from unidentified source.
0234	CVTS/CTSC. CVTS sounded weak.
0419	Clicking now reaching annoying level - no complaints by operational personnel.
0454	CVTS/Houston. CVTS weak at first (apparently mike position.)
1155	Open mike.
1213	CVTS broke up at start of call. (Must have inadvertently released mike key since he repeated call.)
1224	Intermittent pulsed buzz (loop ring signal.)
1240	Xtalk from Black 3 (re Black 3 18/1240Z.)
1247	CVTS/CTSC. CVTS voice level low, quality scratchy.
1324	Open mike (can hear phone ringing very clearly.)
1337	CLE4/CLES. CLES thoughth he was on Blue 5. Got no answer on Black 2.
1426	Open mike.
1505	Loop ring signal.
19/1556	Xtalk from Black 3.
1616	CTSC/CVTS. CTSC very low. Told by CVTS. CTSC immediately improved. (Mike positioning?)
2032	Open mike.
2054	Open mike.
2106	CPSS/CVTS. "You're way down. How am I now? Still way down. Can't understand. How now? OK." (Monitor read both parties loud and clear throughout.)

1.3 Black 3

Date/Time(Z)	Comments
18/1534	Circuit had barrel effect. Gone at 1536Z.
1536	Medium level Xtalk from Black 1.
1538	Someone blowing into mike.
1623	Low-level arcing sound in background.
2245	Someone reported breaking up badly.
19/1240	Xtalk from Black 2.
1507	Xtalk from Black 2.
1556	Echo.
1823	Acoustic feedback squeal. (Monitor unable to read conversation thru it.)
1825	"Check for open mike." (re 1823Z)

1.4 Brown 1

Date/Time(Z)	Comments
18/2016	Voice levels low but quality good. Cleared up by 2030Z.

1.5 Unidentified

Date/Time(Z)	Comments
18/2110	Buzzing.
19/1152	Open mike.
1221	(Reported on Black 1.) "Intermittent voice communication to fall-back area. Believe due to cable. Checking."
1821	Loop ring signal.
2024	Very low level at one end of conversation. (Suspect speaker rather than circuit.)
2041	Noisy time on all loops being monitored. Apparently internal MCC-H interference. Gone at 2042Z.

2.0 Observations During Launch Countdown

2.1 Black 1

Date/Time(Z)	Comments
21/1741	Low Xtalk accompanied by very scratchy sounding tone - estimate 800 Hz.

2.1 Black 1 (cont'd)

Date/Time(Z)	Comments
21/1835	Very low-level Xtalk.
22/0034	"Personnel using Black 1 check headsets - we have an open mike." (Monitor heard no open mike noises on Black 1.)
0208	Open mike.
0210	Increase in level of background noise.
0221	Open mike. Very faint buzz.
0232	CLTC becoming mushy, volume good.
1317	Open mike. Lasted approximately 1 minute.
1442	Loop ring signal.
1450	Loop ring signal.
1514	Continuous buzzing - increasing intensity - presnet until approximately 2038Z. Open mike.
1535	Warbling tone - medium level. Changed to multi-tone with slight doppler quality, then changed to banshee type of howl. Request to check for open mikes. Clear at 1538Z.
1908	Black 2 Xtalking.
2015	FD has echo.
2020	Open mike. Low buzz.
2113	Low buzz.
2126	Xtalk between Black 1 and 2.
2139	CICD/CLTC. CICD extremely low, CLTC mushy.

2.2 Black 2

Date/Time(Z)	Comments
21/2122	CVTS/CTSC. CVTS busy, someone else answered call for him. Voice level very low. CTSC was normal.
2345	Loop ring signal.
22/0107	Loop ring signal.
0107	CVTS/SRO. "How copy?" Loud and clear. OK, I seem to have trouble with Houston NETWORK."
0219	FD was able to read both CVTS and KSTC, but CVTS and KSTC could not read each other.
0223	CVTS/KSTC. No answer from CVTS. KSTC gave long test count. No answer from CVTS. (Monitored KSTC 5X5.)

2.2 Black 2 (cont'd)

Date/Time(Z)	Comments
22/0226	CLTS/CVTS. CVTS started with good volume, then faded and became mushy towards end of conversation.
0235	KSTC gave communications check on OIS RF. 5X5, but had faint 800Hz tone in background.
0240	SRO/CVTS. SRO advised that first portion of CVTS transmissions were cut-off. (Monitor read all of CVTS 5X5.)
0252	CVTS/KSTC. KSTC test count not answered by CVTS.
0418	GMIL reported breaking up (not evident to monitor.)
0535	CVTS/KSTC. "CVTS very weak (monitored very weak also.) How's this? Better." (Must have been mike position.)
0813	Noisy buzzing.
1411	Loop ring signal.
1521	CVTS sounded as though he cut-out one or two times.
1545	CVTS/KSTC. "Do you hear the roar on Black 2 that we do? Negative. Roger, must be here then." (Monitored no roar on Black 2.)
1600	KSTC/CVTS. Discussion of microwave noise on Black 2 and 3 that just cleared up.
1626	10 - 20 seconds burst of static.
1644	Man at pad (ECE) not too clear at times.
1648	Open mike, intermittent buzz.
1806	CTSC/CVTS. CVTS voiced complaint about loop ring signal. Request it be disconnected for duration of mission.
1808	Faint Xtalk.
1839	CVTS/CTSC. CVTS sounded weak.
1913	Black 1 Xtalking.
1937	Loop ring signal.
1945	Loop ring signal.
2023	FD had echo.
2041	FD had echo.
2043	Xtalk from Black 1.

2.2 Black 2 (cont'd)

Date/Time(Z)	Comments
22/2117	CTSC/CVTS. CVTS reports Black 1/Black 2 Xtalk.
2123	Sporadic buzzing pulses - almost like code.
2126	Xtalk Black 1/Black 2.
2131	CVTS. "All personnel check rotary switches." Xtalk Black 1/Black 2. (may have been bussed together.)
2154	Strong Xtalk from loop other than Black 1. Identified at 2251Z as Red 3.
2158	FD has "barrel" sound on this circuit only.
2158	Strong Xtalk from Black 1.
2213	Strong Xtalk from Black 1.
2235	CVTS/CTSC. Both parties were low in volume and had mushy sound.
2239	FD "hollow" again.

2.3 Black 3

Date/Time(Z)	Comments
22/0350	KSTC/FD. FD unable to raise KSTC.
0351	FD informed CVTS of above.
0352	FD/KSTC. KSTC had dialed up 166 but did not read FD. Now reads FD loud and clear. May have problem on loop. (Monitored both parties 5X5.)
0355	FD/KSTC. "Check on loop. KSTC does not read FD on RFYS loop only. Will get this corrected."
0359	"DREC breaking up. Contact now on black phone." (Monitored DREC volume low but not broken up.)
1600	Re Black 2 1600Z - discussion of microwave noise.

2.4 Black 4

Date/Time(Z)	Comments
22/1007Z	Noise swell.

2.5 Unidentified

Date/Time(Z)	Comments
21/1811	Test count by unidentified party. Voice level good, but slightly distorted.
2000	Loop ring signal.

2.5 Unidentified (cont'd)

Date/Time(Z)	Comments
22/1316	Unidentified person giving test count.
1815	Open mike squeal. Duration 2 - 3 seconds.

APPENDIX IV

Detailed Observations at KSC - CIF Building

This appendix contains a chronological listing by channel of OIS-A performance comments.

1.0 Observations During CDDT

1.1 BLACK 1

Date/Time(z)		Comments
1-19-68	1000	Channel out at normal position
	1045	Position 1 repaired, but quality is poor
	1310	Levels are low
	1445	Levels low
	1810	Open microphone

1.2 BLACK 5

1-19-68	1310	Crosstalk and noise heard
	2100	Breaking up was reported by a user in Room 307

1.3 BLACK 6

1-19-68	1310	Crosstalk and noise heard

1.4 RED 5

1-19-68	1545	A high background noise was heard
	1710	User heard breaking-up
	1710	Red 5 bussed with Red 6

2.0 Observations During Launch Countdown

1.1 BLACK 1

1-19-68	1730	"Flight heard loud and clear." Difference in user levels is evident.

	2130	User complained of crosstalk between Black 2. It was not detected at the monitor position.
	2145	User levels appear normal.

1.2 BLACK 5

1-19-68	2140	Users' voices sound choppy.

1.3 BLACK 6

1-19-68	2030	Crosstalk and noise were heard.

1.4 RED 1

1-19-68	2030	Chopping of the middle of words was noted.

1.5 RED 3

1-19-68	2030	Crosstalk from Black 1
	2030	User complained of breaking up, but it was not heard by monitor. Some chopping occurring in middle of words.

BELLCOMM, INC.

Subject: Performance of Operational Intercommunication System (OIS-A) During Apollo 5

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